Name: Liu Yihe

Birth: 2002/11/23 **M/F:** Male

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Education

Beijing Institute of Technology **Beijing, China**

Bachelor's degree 2021/09-2025/06

Main course: Circuit and Analog Electronics, Semiconductor Physics, Digital Circuits and System Design, Principles and Simulation of Microelectronic Devices, Integrated Circuit Engineering, Electrical and Computer Engineering Internship, Electronic Integrated Design, Principles and Applications of Embedded Systems, etc.

Project Experience

1. **Build the ARM Cortex-M0 system on the designated FPGA board, and write software programs to make it run.**

2024 spring

- **Keywords:** SoC design, Verilog HDL, FPGA system, ARM architecture, C Language.
- **Details:** Referring to Arm® Cortex®-M0 DesignStart™ Eval FPGA User Guide, I built an ARM Cortex-M0 System Design Kit (called CMSDK) on EGO1 board, which is based on XC7A35T-1CSG324C FPGA chip. My CMSDK is based on AHB bus, and it has one Cortex-M0 core and one APB subsystem. It also has a 64kb SRAM, a 64kb flash, SWD, iopads, UARTs, dual timer, timers, watchdog. Then my teammate wrote software programs on Keil uVision5, and our board ran flowing water LED and other simple applications smoothly. While I was designing my CMSDK, the biggest problem was that the number of BRAM in FPGA chip was not big. Therefore, we shouldn`t only think

about making the performance of the instrument super high, but also consider the resource limitations of the device itself and our actual needs. Considering that software programs are simple and bootloader was needed in flash, I designed a 64kb SRAM on chip and a 64kb flash on chip.

2. **Real time monitoring device for environmental sound frequency.**

2024 spring

- **Keywords:** Embedded system, Op-Amp design, C language, Digital signal processing.
- **Details:** We built a system on a solderless breadboard, which was based on a Raspberry Pi Pico Board. The microphone to monitor environmental sound can output analog signal with a extremely small current, so we should design a suitable operational amplifier. Then I wrote program in C language. The MCU can make the AC signal change to DC signal, then the program can do digital signal processing and generate the spectrum of sound in the environment. After that, spectrum diagram will be displayed on a OLED screen.

3. **Design a UART module which is based on AXI bus protocol.**

2024 summer

- **Keywords:** Digital IC design, Verilog HDL, AMBA bus protocol.
- **Details:** I designed a three-wire UART module which is based on AXI bus. To finish this task, I referred a kind of three-wire UART which is based on APB bus.

4. **Design a robot car system with joint development of FPGA and MCU.**

2024 fall & winter

- **Keywords:** Embedded system, C Language, Digital IC design, Verilog HDL, FPGA.
- **Details:** I use the MCU as the brain of robot, and FPGA is to some of data transmission and data processing, which is EQ6HL130CSG484. Here are some innovations of this project. (a)The number of UART in the MCU is not enough, so I design a UART receiver and a UART transmitter, and both of them aren`t based on any bus (so that they can do parallel operation in the FPGA and don`t need any core to control them). Two UART receivers receive the signal from two peripherals of the robot, the FPGA does data processing and creates new UART signal (based on a new communication protocol designed by me), then the signal is transmitted to MCU by a UART transmitter. (b) The

FPGA need to transparently transmit I2C signal, but single assignment statement in Verilog HDL don`t work for inout signal. Thus, I design a module which is for transparent transmission of I2C signal. (c) Other parts of the FPGA design like module for PWM generation, module for eliminating the chattering of butters and so on, will be omitted.

Research Techniques and Skills

Skills: Verilog HDL, C Language, circuit soldering, WSL (Windows Subsystem for Linux).

Apps: Visual Studio Code, Modelsim, MATLAB, Vivado, Elinx, Keil uVision, NI Multisim, L-Edit, RStudio, GaussView.

Favorite app: Visual Studio Code.

Research Interests

1. **Digital IC Design and SoC Design Technology**:

Hardware Description Language (HDL), High-Level Synthesis (HLS), digital IC backed design.

2. **FPGA system**
3. **Processor and Computer Architecture**
4. **Embedded System & Programming**